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13. ABSTRACT (Maximum 200 words)  A poster paper was shown at the AGU Meeting with interest from various groups. The equatorial and high latitudes data set included magnetically quiet periods and magnetically disturbed periods. It was found that extremely high altitude plumes developed on the magnetic equator in early phases of 7 magnetic storms. Comparisons were made between 6300 A depletions and phase fluctuations in a cooperative study with Ms. Colerico, our AASERT graduate student. The spatial correlation between optical depletions and phase scintillation worked well but in some case the phase fluctuations were only of moderate level. A paper has been published showing that during low solar flux years and long periods of magnetic quiet, the high latitude irregularities either disappear or show low levels at extremely high latitudes.				
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**OFFICE OF NAVAL RESEARCH**

**QUARTERLY REPORT**

**for**

**1 April 1995 through 30 June 1995**

**GRANT No.: N00014-89-J-1754**

**THE EFFECTS OF MAGNETIC STORM PHASES ON  
F-LAYER IRREGULARITIES  
FROM AURORAL TO EQUATORIAL LATITUDES**

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## **A. AGU MEETING: USING THE AVAILABLE GPS DATA STREAM**

In the last report we discussed our program of using the data from several of the approximately 50 stations of the International GPS Service to study various ionospheric parameters but principally scintillation. With this available data, the rapid fluctuations of Total Electron Content levels are ascribed to phase scintillations produced by ionospheric irregularities.

There was a great deal of interest in the poster paper at the AGU Meeting from those doing ionospheric studies. Total Electron Content and variations in TEC were shown for two periods in 1994 and one period in 1995; in each period there were both quiet periods and magnetic storm days. The data from four stations near the magnetic equator were compared to optical, radar, and scintillation measurements obtained by field programs. In a year of solar minimum at the equator such as 1994, irregularities both at the equator and at high latitudes normally show lower occurrence and lower intensity than during years of solar maximum. This is particularly true during periods of quiet magnetic activity. There were surprisingly relatively high amplitude scintillation levels. Phase scintillation excursions were moderate but they correlated well with the radar and optical data. A comparison with 6300 Å depletions recorded by the all-sky camera at Arequipa was made by Ms. Colerico and the group working on the GPS data. Nights when depletions were observed were the nights when strong fluctuations were observed on the GPS signal.

The motion equatorward of irregularities at high latitudes during a magnetic storm has centered on data from Canada. The stations which are reduced include Yellowknife, Algonquin, and St. Johns. Thus we have an auroral station and two nearby sub-auroral observatories. For specific magnetic storms we recorded and showed the descent of the irregularity region.

Observations are available for all latitudes from JPL. The focus of this study is on the correlation of scintillation activity at high latitudes and the development during the same periods of phase scintillation in the equatorial region. The focus of the PRIMER-N.E. Consortium Study of ONR will be on scintillation activity at the equator.

## **B. ANOMALY REGION-MIDDLE LATITUDE IONOSPHERIC STUDIES**

While we have pointed out the variation of the effective latitude of the anomaly region, we have not studied it. The importance of this region is seen in recent studies of 4 GHz signals at a variety of latitudes encompassing the anomaly latitudes and the lower middle latitudes. Can the intensity and time variations of the anomaly region be used in forecasting equatorial scintillation? Our aim is to see what effect the anomaly region movements have on scintillation activity and intensity.

## **C. PUBLICATION**

The paper by J. Aarons, L. Kersley, and A.S. Rodger "The sunspot cycle and "auroral" F layer irregularities appeared in Radio Science 30, 631-638, May-June 1995

#### **D. THE ONR AASERT PROGRAM IN UPPER ATMOSPHERE AND IONOSPHERIC PHYSICS**

Ms. Colerico has continued in her study of ground based imaging observations of equatorial irregularities using data taken by the Boston University imager in Arequipa, Peru. She has assisted Dr. Aarons in a comparison study between TEC and scintillation measurements taken from GPS satellites and optical observations of Spread-F plumes taken at the imager site in Peru. There is a high correlation between the occurrence of scintillation activity and the passage of Spread-F plumes through the satellite's path. Some results from this comparison were presented in the AGU poster paper by Aarons, Mendillo, and Yantosca at the Spring 1995 AGU meeting in Washington, D.C. Ms. Colerico has continued her research into the 6300A airglow feature which moves from north to south through the field of view of the Arequipa imager. This feature is referred to as the "Brightness Wave". This newly discovered phenomenon is being studied thru comparing coincident FPI measurements and optical observations of the "Brightness Wave". There are suggestions that the "Brightness Wave" may be related to the Midnight Temperature Maximum (MTM). The passage of the "Brightness Wave" correlates well with local minimums in the zonal winds, abatements/reversals of the meridional winds, and a local maximum in temperature all of which are consistent with the effect of the MTM on the neutral winds. These results were presented by Ms. Colerico in an oral presentation at the CEDAR meeting and a poster paper at the IUGG meeting both held in Boulder, Colorado in June 1995.

Ms. Colerico is also monitoring the Goose Bay imager. A site visit is being planned for a later date in order to update the imager's control software.